

Patent Claims:

1. Microorganisms, characterized in that they are able to utilize cyclopentene derivatives selected from compounds of the general formula



VII

5 in which R¹ denotes C₁-C₄-alkyl, C₁-C₄-alkoxy, aryl or aryloxy, as sole nitrogen source, as sole carbon source or as sole carbon and nitrogen source, and enzyme extracts therefrom.

2. Microorganisms and extracts according to Claim 1,
10 in which the microorganisms are selected from the genera Rhodococcus, Gordona, Arthrobacter, Alcaligenes, Agrobacterium/Rhizobium, Bacillus, Pseudomonas or Alcaligenes/Bordetella.

3. Microorganisms and extracts according to Claim 1
15 or 2, in which the microorganisms are selected from the species Alcaligenes/Bordetella FB 188 (DSM 11172), Rhodococcus erythropolis CB 101 (DSM 10686), Arthrobacter sp. HSZ 5 (DSM 10328), Rhodococcus sp. FB 387 (DSM 11291), Alcaligenes xylosoxydans ssp. denitrificans HSZ
20 17 (DSM 10329), Agrobacterium/Rhizobium HSZ 30, Bacillus simplex K2, Pseudomonas putida K32 or Gordona sp. CB 100 (DSM 10687), and the functionally equivalent variants and mutants thereof.

4. Enzyme having N-acetylamino-alcohol hydrolase
25 activity, obtainable from microorganisms according to any of Claims 1 to 3 and able to hydrolyse cyclopentene derivatives selected from compounds of the general formula



VII

30 in which R¹ denotes C₁-C₄-alkyl, C₁-C₄-alkoxy, aryl or aryloxy, and functionally equivalent variants and mutants

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th reof.

5. Enzyme according to Claim 4, characterized by

- a) a pH optimum of pH 7.0 \pm 1.0;
- b) a temperature optimum between 25°C and 30°C at a pH of 7.0, and
- c) a K_m for the substrate 1-acetylamino-4-hydroxymethyl-2-cyclopentene of 22.5 mM \pm 7.5 mM (30°C, 100 mM phosphate buffer),

and functionally equivalent variants and mutants thereof.

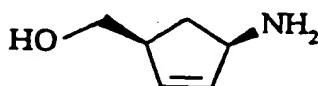
6. Enzyme according to either of Claims 4 or 5, further characterized by

- d) an N-terminal amino acid sequence of Thr-Glu-Gln-Asn-Leu-His-Trp-Leu-Ser-Ala-Thr-Glu-Met-Ala-Ala-Ser-Val-Ala-Ser-Asn; and

- e) a molecular weight, determined by SDS-PAGE, of 50 kD;

and functionally equivalent variants and mutants thereof.

7. Process for the preparation of (1R,4S)- and/or (1S,4R)-1-amino-4-(hydroxymethyl)-2-cyclopentene of the formulae I and II

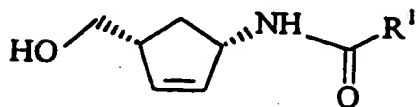


I

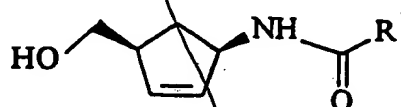


II

and/or of (1S,4R)- and/or (1R,4S)-amino alcohol derivatives of the general formulae III and IV



III

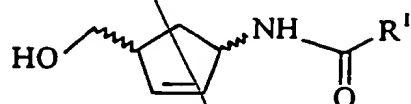


IV

in which R¹ denotes C₁-C₄-alkyl, C₁-C₄-alkoxy, aryl or aryloxy, comprising the conversion of a cyclopentene

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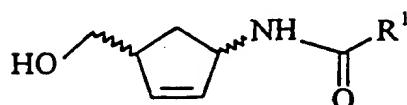
derivative of the general formula



VII

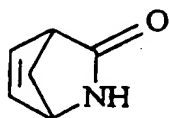
in which R¹ has the stated meaning, by means of a micro-organism and/or enzyme product according to Claim 1, of an enzyme according to Claim 4 and/or of a penicillin G acylase, into the compounds of the formulae I and/or II, and, where appropriate, isolation of these compounds and/or of the amino alcohol derivatives of the formulae III and/or IV resulting in this conversion.

8. Process according to Claim 7, characterized in that the cyclopentene derivative of the general formula



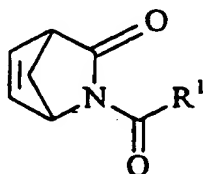
VII

in which R¹ has the stated meaning, is prepared by, in a first stage, acylating (+)-2-azabicyclo[2.2.1]hept-5-en-3-one of the formula



V

to give a (+)-2-azabicyclo[2.2.1]hept-5-en-3-one derivative of the general formula

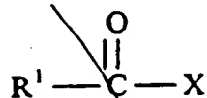


VI

in which R¹ has the stated meaning, and, in a second stage, reducing this compound to a cyclopentene derivative of the general formula VII.

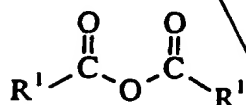
9. Process according to Claim 8, characterized in that the acylation in the first stage is carried out with a carbonyl halide of the general formula

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VIII

in which X denotes a halogen atom, and R¹ has the stated meaning, or with a carboxylic anhydride of the general formula



IX,

in which R¹ has the stated meaning.

- 5 10. Process according to one of Claims 8 or 9, characterized in that the acylation in the first stage is carried out in an aprotic solvent.
- 10 11. Process according to one of Claims 8 to 10, characterized in that the reduction in the second stage is carried out with an alkali metal or alkaline earth metal borohydride, an alkali metal or alkaline earth metal aluminium hydride and/or with Vitride.
- 15 12. Process according to one of Claims 8 to 11, characterized in that the reduction in the second stage is carried out in a protic solvent.
- 20 13. Process according to one of Claims 7 to 12, characterized in that the reaction of the cyclopentene derivative of the general formula VII is carried out using microorganisms of the genus Rhodococcus, Gordona, Arthrobacter, Alcaligenes, Agrobacterium/Rhizobium, Bacillus, Pseudomonas or Alcaligenes/Bordetella.
- 25 14. Process according to one of Claims 7 to 13, characterized in that the reaction of the cyclopentene derivative of the general formula VII is carried out using a penicillin G acylase from microorganisms of the species Bacillus megaterium or Escherichia coli.
- 30 15. Process according to one of Claims 7 to 14, characterized in that the reaction in the third stage is carried out at a temperature from 20 to 40°C and at a pH from 5 to 9.

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